Learned Society Priority Topics
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IChemE’s ambition, set out in Strategy 2024, is to be recognised as a vibrant learned society that materially impacts on the Global Grand Challenges.

One of the first tasks the Learned Society Committee set itself was to identify the priority topics on which IChemE would concentrate its delivery. It chose three: Responsible Production, Major Hazards Management, and Digitalisation.

This document provides the detail on what IChemE might achieve in these three areas, both in 2021 and by the end of 2024. It was developed with the input from IChemE’s Special Interest Groups and other members active in the relevant areas.

Chemical engineering will play a key role in addressing many Sustainable Development Goals. It already contributes an above-average proportion of the research in five areas:

- affordable and clean energy (SDG7)
- responsible consumption and production (SDG12)
- life below water (SDG14)
- zero hunger (SDG2)
- clean water and sanitation (SDG6)

This makes IChemE uniquely well placed to contribute to the debate and to effect change. Delivering on the priority topics, as set out on the following pages, is one example of how we can do this.

Having a clear set of focus topics, a shared vision of where we want to be, and clear plan for how we will get there, will allow IChemE to bring together the diversity and capabilities of the members to deliver a more united, focussed response to these challenges.

IChemE is already a vibrant learned society. We have 20 Special Interest Groups and 35 member groups in 11 countries. Between them, they provide a broad and stimulating programme of activities across a huge range of topics with activities taking place almost every day.

The majority of these already align with the priority topics. We hope that this document will sharpen the focus of our delivery and inspire more people – members and external partners alike – to engage in IChemE’s learned society work.

If you have any thoughts, comments and suggestions, we would love to hear from you. Please contact us at lsc@icheme.org

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Professor Jarka Glassey CEng FIChemE  
Vice President (Learned Society)  
and Chair of the IChemE Medals & Prizes Committee
Purpose – what does IChemE hope to deliver as a learned society?

IChemE’s purpose, particularly through being a vibrant learned society, is to advance the contribution of chemical engineering in solving society’s challenges and improving its wellbeing by providing support and encouragement to our members, advice to society’s leaders, and access to our professional knowledge network.

This overarching purpose will continue to be delivered through individual purposes of the selected priority topics, as follows:

**Responsible Production**

The individual purpose is promoting improved chemical engineering technologies to minimise the societal and environmental impact and improve the sustainability of production and consumption cycles by provision of improved processes, products, education, and focussed direction.

a) Context: chemical engineering is a major driver in advancing society. Although it has contributed to many of the most pressing problems of the day, it holds the key to addressing the same problems through advancement and systems thinking that chemical engineering has at its core. The concept of responsible production drives an improved use of chemical engineering for the benefit of society. It recognises all forms of impact and detriments, and the need to avoid them, in a sustainable way, locally and worldwide when developing or adapting processes, products, and activities undertaken.

b) Detriments include not only the technical aspects of challenges such as waste, climate change, economic and environmental damage, but also the societal impacts highlighted directly or indirectly by the majority of the UN’s 17 SDGs which are listed in the appendix.

c) These SDGs also highlight the need, within the role of responsible production, to consider consumption, security of supply, product safety and ethical engineering that encompass sustainability, action on climate change and supporting a move to net zero, systems thinking and life cycle assessment, process intensification/efficiency gains, and the circular economy.

**Major Hazard Management**

The individual purpose is advancing the understanding and application of managing major hazards worldwide for the benefit of society.

a) Context: managing major hazards saves lives and safeguards the environment. Chemical engineers have significant experience in this area. IChemE will achieve significant societal impact by helping chemical engineers share this experience within organisations and externally, develop the understanding and apply it to new, potentially non-traditional chemical engineering areas, and advance the techniques and methodologies used.

**Digitalisation**

The individual purpose is to raise awareness and capability for responsible application of digital technologies worldwide for the benefit of IChemE members, the profession, and society.

a) Context: digital technologies are impacting how we do work and what we work on. This change affects all of us. The profession is changing due to the widespread application of new technologies including, but not limited to, systems thinking, big data, machine learning, artificial intelligence, process control and automation, virtual reality, cyber security, and process design.

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1 By this, we mean addressing all areas that chemical engineering will impact on within society. This extends from identification of a need, through delivery and fulfilment of that need and completing the cycle by management of the detriments and outcomes of fulfilling those needs.
Vision – where do we want to be within the scope of Strategy 2024?

Responsible Production
We will have clear ambitions to deliver tangible outputs for use by members and other stakeholders, to the benefit of wider society, on aspects of sustainability and responsible production, as set out in the Aims section.

Major Hazard Management
Our ambition is for IChemE to be a peer group leader in sharing our knowledge in this area, and learning from others.

Digitalisation
IChemE will understand how digital technologies, as enabled by systems thinking, engineering, and science, affect chemical engineering professionals. IChemE needs to ensure members are aware of the impacts and prepared for change. It will seek to develop member capabilities in the critical enablers for use of these tools – ethical and responsible leadership, education and lifelong learning, and organisational aspects.
Aims – we will have achieved our vision if we are…

Responsible Production

Known as a peer group leader on climate change issues, with a clear vision supporting actions that help mitigate and adapt to the global impact of climate change in a meaningful way.

Encouraging and challenging IChemE’s SIGs across the spectrum to develop technical action plans to both support:

a) delivery on the promotion of responsible production, including the IChemE climate change position, in their area.

b) the use of the outputs to encourage chemical engineers and the industries they work in towards taking greater responsibility for their impact on the environment and communities throughout all phases of production. Those responsibilities should be aligned with the UN’s SDGs.

Promoting professional ethics at all levels from undergraduate teaching and academic research, to providing membership with tools and good practice guides that reflect the societal impact of engineering decisions.

Actively supporting and sharing the insights gained from high-level systems engineering and whole of process life cycle assessment works outside the traditional boundaries of chemical engineering that can be used in collaboration successfully.

Major Hazard Management

Respected for continuing professionalism and technical competence in managing major hazards in a holistic way using systems and life cycle approach.

Recognised as a vibrant learned society and thought leader that materially impacts the management of major hazards.

Ensuring the lessons learnt by the process industries are understood across the engineering professions.

Recognised as a respected reference point within the engineering professions and with industry for benchmarking, sharing best practice and insight, education and professional competence, and developing solutions for common problems.

Digitalisation

Respected for continuing professionalism and technical competence of our members in managing digital tools in a responsible, ethical, and holistic manner.

Recognised as a thought leader that provides valuable knowledge, Continuing Professional Development (CPD), member and professional networks for the application of digital technologies in the process industries.

Known for sharing valuable knowledge within society to provide the necessary understanding of digital technologies and their application in the process industries, including their benefits and disadvantages.

Developing outputs that have broad application across these seven subject areas: education, innovation and research, energy, food, drink and nutrition, health and wellbeing, manufacturing and resources, major hazards management, and water.
Scope

Responsible Production includes, but is not limited to: sustainability, action on climate change and supporting a move to net zero, systems thinking and life cycle assessment, process intensification/efficiency gains, circular economy, ethical engineering, and the security of supply chains.

We will provide direction and advice on how Communities of Practice (CoPs), SIGs, and local and regional Members Groups (MGs) should align aspects of their programme of activity against IChemE’s strategy and specifically the aims of responsible production.

The LSC will within this topic focus on:

■ the medium term – delivery to 2024;
■ encouragement of the bodies referred to above to develop ideas and collaborate in work that delivers against the aims of responsible production;
■ encouragement for the identification of deliverables for workplace, education and member awareness, re-skilling, and upskilling;
■ encouraging the development of tools and outputs, that have impacted on and benefitted broader society, for use by chemical engineers.

The following areas are specifically out of scope for this work:

■ any changes to IChemE’s objects as set out in the Royal Charter;
■ any changes affecting qualifications or accreditation.

Where the scope is outside the learned society we will:

■ through the Vice President Learned Society, provide strategic advice and direction to the relevant bodies in IChemE.

Within 2021 we will:

■ initiate the process for the creation and delivery against a climate change action plan that supports the IChemE statement on climate change;
■ initiate a process to scope and develop further work on Life Cycle Assessment (LCA) building on the project carried out in 2020 by identifying a group of volunteers to lead and oversee the project, and develop their Terms of Reference (ToR);
■ start identifying gaps for member education awareness, reskilling and upskilling;
■ start gap analysis on these remaining areas of responsible production and identify potential outputs:
  a) process intensification/efficiency gain;
  b) circular economy;
  c) ethical engineering;
  d) security of supply chains;
■ provide direction and support to the delivery of policy papers, webinars, and other activities related to responsible production and the ongoing Covid-19 outbreak.
By the end of 2021 we will have:

■ initiated work to identify knowledge gaps and potential outputs on:
  a) process intensification/efficiency gains
  b) circular economy;
  c) ethical engineering;
  d) the security of supply chains;
■ delivered a climate change action plan that builds on the position statement;
■ further scoped an LCA project including the vision of deliverables;
■ identified existing alignment of SIG, CoP and regional group activity with responsible production and encourage delivery of more aligned outputs;
■ identified initial suitable training materials to make available on a central platform for reskilling and upskilling chemical engineers that is focused on sustainability and aligned with the SDGs;
■ set up process for conducting gap analysis of outputs in identified areas;
■ developed and initiated a plan for engaging and enthusing IChemE membership around the responsible production priority topic via:
  a) webinars, live and recorded, for worldwide member access and use;
  b) production of other relevant curated materials distributed and held in the Knowledge Hub;
  c) direct, open and transparent engagement with all stakeholders listed in the table above including, where relevant, formal consultation.

Expected achievements by 2024

■ the LSC will have delivered and implemented a clear action plan resulting from IChemE’s climate change position statement;
■ the LSC will have a project on LCA in place with key, identifiable deliverables;
■ the training hub for sustainability skills is well established and used, with additional materials and courses being regularly developed and added;
■ SIGs/CoPs/regional groups or specific working groups will have in their work plans or be implementing, collaboratively or individually, work to deliver activities and outputs on:
  a) sustainability;
  b) action on climate change and supporting a move to net zero;
  c) systems thinking and life cycle assessment;
  d) process intensification/efficiency gains;
  e) circular economy;
  f) ethical engineering;
  g) the security of supply chains.

Strategic outcomes

■ IChemE has generated clear positions on all aspects of responsible production with vibrant work programmes and outputs being generated in several of them;
- Outputs generated within the responsible production work are being used by members to support their work and by IChemE to influence policy makers internationally;
- IChemE work supports the use of LCA as a broadly used tool in multiple industries;
- Measurable progress in IChemE deliverables on climate change;
- IChemE has an understanding of its gaps in the remaining areas of responsible production and work is underway to develop materials to address these.
We recognise that major hazards management, including process safety, is important in all fields of chemical engineering, affecting process industries and other sectors and impacting every IChemE member.

The Major Hazards Committee (MHC) is the volunteer body which has been established by the Board of Trustees to lead major hazards strategy within IChemE.

The MHC provides an environment where the agendas of the different IChemE major hazards groups involved can be communicated, coordinated and aligned to an overarching IChemE strategy on major hazards management. The MHC will develop and set the priorities that will result in promotion of good practice and continual improvement in major hazards management across industry.

Major hazards includes the elements of process safety.

While each constituent group of the MHC collectively and collaboratively work together, they also undertake their own group activities, under the framework of the new strategy on major hazards management:

Safety and Loss Prevention Special Interest Group
- IChemE’s Safety and Loss Prevention SIG provides an international forum for the technical and professional development of members working on, or interested in, safety and loss prevention.

IChemE Safety Centre (ISC)
- the ISC is a not-for-profit multi-company, subscription based, industry consortium, focused on improving process safety, which shares, analyses, and applies safety related thinking.

Loss Prevention Bulletin Editorial Board
- a leading source of process safety case studies with an archive of more than 40-years of lessons learned from accidents.

Process Safety and Environmental Protection Journal (PSEP)
- PSEP aims to be the principal international journal for publication of high quality, original papers in the branches of engineering concerned with the safety of industrial processes and the protection of the environment.

IChemE Hazards Committee
- Hazards is Europe’s premier major hazards management conference, with its technical program curated by the committee.

The following area is specifically out of scope for this work:

IChemE’s Qualifications department manage the implementation and coordination of the Professional Process Safety Engineer registration. This registration provides public recognition to peer-reviewed practitioners working in process safety related roles.
Where the scope is outside the learned society we will:

In order to advance the understanding and application of managing major hazards, the MHC will raise awareness of and promote the Professional Process Safety Engineer registration. It will also support the work of the qualifications team to ensure adequate major hazards management input into the registration standards. We will provide strategic advice and direction to the wider IChemE on accreditation, qualifications and CPD.

Within 2021 we will:

The very recently established MHC will:

■ agree and document IChemE’s overarching strategy on major hazards management;
■ bring together the constituent groups active in major hazards management to work collectively and also individually on implementing IChemE’s strategy on major hazards management;
■ enhance the communication, coordination, and alignment within IChemE to advance the understanding and application of managing major hazards worldwide;
■ develop ongoing plans to further integrate the constituent groups’ major hazards management work;
■ establish a process to develop and commence initial priority projects on:
   a) capability and competence development;
   b) lessons learned.

Expected achievements by 2024

■ all the groups across IChemE which are active in major hazards management will be actively communicating and leveraging each other’s work and expertise, and will be coordinated and aligned to maximise impact in the delivery, collaboratively and individually, of the IChemE strategy on major hazards management;
■ a project team will have developed a plan as to how IChemE can most effectively engage beyond the process industries, and work in partnership with others to support cross sector learnings and sharing of knowledge, including ensuring the lessons learnt by the process industry are understood across the engineering professions;
■ the MHC will develop and implement a clear action plan informed by the Strategy on major hazards management;
■ this will develop and evolve over the next few years and will focus on priorities to have maximum impact worldwide for the benefit of society.

Strategic outcomes

There are four aims for major hazards management under the leadership of the MHC that align with IChemE’s Strategy 2024. These reflect the strategic outcomes:

■ respected for continuing professionalism and technical competence in managing major hazards in a holistic way using a systems and life cycle approach;
■ recognised as a vibrant learned society and thought leader that materially impacts the management of major hazards;
■ acknowledged as a peer group leader in which an engaged membership receives and adds value;
■ known as a high performing organisation delivering significant value and proactively learning from others.
Scope

Provide information and resources so IChemE members develop their knowledge and skills about digital tools and chemical engineering.

■ a three-year strategy initiative, comprising multiple projects with a focus on the medium term – year 2024;
■ focus on IChemE members;
■ focus on the development of deliverables for member awareness, education, workplace re-skilling, and upskilling;
■ focus on digitalisation. In this strategy initiative, digital tools include systems thinking, big data, artificial intelligence, automation, virtual reality, and cyber security. Include ethical leadership for use of these tools. (These headings are derived from Aim Two of the IChemE Strategy 2024 and from the Engineering Grand Challenges);
■ will work across IChemE groups to support the digitalisation efforts of groups, including SIGs and CoPs.

The following areas are specifically out of scope for this work:

■ another project, IChemE 100, considers digital technologies over a longer time horizon;
■ another project, led by CEO is an external project with other professional engineering institutions, and it is separate to this work;
■ distinct from the technology projects led by CEO to make internal systems improvements to build IChemE into a high-performing organisation.

Where the scope is outside the learned society we will:

■ through the Vice President Learned Society and the Subject Area Lead for Education, Innovation and Research, provide strategic advice and direction to the wider IChemE on accreditation, qualifications, and CPD. This includes liaison with:
  a) BoT;
  b) CEO; and
  c) Education and Accreditation Forum (EAF).

By the end of 2021 we will:

■ establish the digitalisation Technical Advisory Group (Digi TAG), an international diverse group of IChemE members with digitalisation expertise, to provide leadership and advice;
■ raise awareness across IChemE membership with articles in The Chemical Engineer;
■ support the launch of a new academic journal in digitalisation, Digital Chemical Engineering;
■ promote the inclusion of systems thinking, artificial intelligence, security, and ethical leadership of technology in IChemE accredited chemical engineering degrees. We are doing this through the Accreditation of Higher Education Programme in 2021 by liaising with the EAF who are reviewing the university accreditation requirements;
engage with SIGs and CoPs to raise awareness of digitalisation, encourage activity and align mutual strategy and activities;
collate and summarise existing work from IChemE groups on digitalisation and make these centrally available through the IChemE website and Knowledge Hub;
identify gaps in existing materials and support groups to run webinars and workshops to upskill members on digitalisation;
identify resources for cyber security for chemical engineers to be available via the IChemE website;
support the delivery of the Advances 2021 Conference;
identify suitable learning resources for university education and professional CPD and make them available to IChemE members.

Expected achievements by 2024
ongoing communications for growing member awareness and knowledge via The Chemical Engineer, webinars, IChemE journals, and books;
ongoing engagement by Digi TAG members with the Learned Society Forum (LSF), SIGs, and CoPs;
bring together groups to provide a suite of offerings that can be used for education programmes for universities;
identify lifelong learning resources for all IChemE members to up-skill and re-skill for digitalisation;
identify requirements and support delivery of resources for up-skilling:
  a) cyber security for chemical engineers; and
  b) ethical and responsible leadership of digital tools for chemical engineers;
propose mechanism for co-ordination across LSF, SIGs, and CoPs on digitalisation;
participate in or contribute to IChemE events such as conferences and the Centenary project.

Strategic outcomes
materials identified and outputs generated within the digitalisation work are being used by:
  a) Members to support their work across multiple industries;
  b) Educators to develop and teach university programmes;
  c) Employers across multiple industries to develop their staff;
ongoing publishing of resources from and for experts, and research in these areas;
vehicles for ongoing activity in digitalisation, to understand and drive developments, including member lifelong learning and member networking opportunities, are identified.
Appendix 1 – The Grand Challenges

The Grand Challenges for Engineering

The list was identified from members of the National Academy of Engineering, the United Nations Millennium Development Goals, and the White House Strategy for American Innovation.

1. Engineer better medicines
2. Advance health informatics
3. Reverse-engineer the brain
4. Manage the nitrogen cycle
5. Provide access to clean water
6. Prevent nuclear terror
7. Make solar energy economical
8. Provide energy from fusion
9. Develop carbon sequestration methods
10. Restore and improve urban infrastructure
11. Secure cyberspace
12. Enhance virtual reality
13. Advance personalized learning
14. Engineer the tools of scientific discovery

The United Nations’ 17 Sustainable Development Goals (SDGs)

1. No Poverty
2. Zero Hunger
3. Good Health and Well-being
4. Quality Education
5. Gender Equality
6. Clean Water and Sanitation
7. Affordable and Clean Energy
8. Decent Work and Economic Growth
9. Industry, Innovation and Infrastructure
10. Reduced Inequality
11. Sustainable Cities and Communities
12. Responsible Consumption and Production
13. Climate Action
14. Life Below Water
15. Life on Land
16. Peace and Justice Strong Institutions
17. Partnerships to achieve the Goal
# Appendix 2 – abbreviations used in this document

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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BoT</td>
<td>Board of Trustee</td>
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<tr>
<td>CoP</td>
<td>Community of Practice</td>
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<tr>
<td>CPD</td>
<td>Continuing Professional Development</td>
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<td>Digi TAG</td>
<td>Digitalisation Technical Advisory Group</td>
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<tr>
<td>EAF</td>
<td>Education and Accreditation Forum</td>
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<td>ISC</td>
<td>IChemE Safety Centre</td>
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<td>LCA</td>
<td>Life Cycle Assessment</td>
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<td>LSC</td>
<td>Learned Society Committee</td>
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<td>LSF</td>
<td>Learned Society Forum</td>
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<td>MG</td>
<td>Member Group</td>
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<tr>
<td>MHC</td>
<td>Major Hazards Committee</td>
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<td>PSEP</td>
<td>Process Safety and Environmental Protection Journal</td>
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<td>SDG</td>
<td>Sustainable Development Goals</td>
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<tr>
<td>SIG</td>
<td>Special Interest Group</td>
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<tr>
<td>ToR</td>
<td>Terms of Reference</td>
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Led by members, supporting members and serving society

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